Amtrak Roadway Worker Fatality
Bowie, Maryland
April 24, 2018

Accident Report

NTSB/RAR-21/02
PB2021-100935

National Transportation Safety Board

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PB2021-100935
Notation 67454
Adopted September 27, 2021

Railroad Accident Report

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National Transportation Safety Board

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National Transportation Safety Board. 2021. *Amtrak Roadway Worker Fatality, Bowie Maryland, April 24, 2018*. Publication Type NTSB/RAR-21/02. Washington, DC: NTSB.

Abstract: On April 24, 2018, about 8:58 a.m. local time, northbound Amtrak (National Railroad Passenger Corporation) train 86 struck and killed an Amtrak rail gang watchman near the Bowie State Train Station in Bowie, Maryland. The accident occurred on main track 1 at milepost 119.2 on Amtrak's Northeast Corridor. At the time of the accident, main track 2 was out of service under a continuous track outage for track maintenance, and the adjacent tracks immediately to the east and west of main track 2 (main tracks 1 and 3, respectively) were in service for train movements. Three watchmen were protecting the roadway workers and watching for trains moving on adjacent tracks to warn workers of approaching trains. One watchman was positioned near the boarding platform, another was positioned in a nearby curve, and the third watchman was positioned toward the end of the curve, near a work gang of welders. The third watchman was the employee struck by the train. No passengers or crewmembers on Amtrak train 86 were injured. The National Transportation Safety Board (NTSB) identified the following safety issues: inadequate site-specific safety risk assessment, unsafe train speeds in established work zones, and ineffective roadway worker protection. As a result of this investigation, the NTSB makes safety recommendations to the Federal Railroad Administration; Amtrak; and Amtrak and all Class I Railroads. NTSB also reiterated a recommendation to Amtrak and reiterated and classified a recommendation to the Federal Railroad Administration.

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Abbreviations and Acronyms

ACSES	Advanced Civil Speed Enforcement System
Amtrak	National Railroad Passenger Corporation
CFR	*Code of Federal Regulations*
FAMES	Fatality Analysis of Maintenance-of-Way Employees and Signalmen
FRA	Federal Railroad Administration
MARC	Maryland Area Rail Commuter
MAS	maximum authorized speed
MP	milepost
NTSB	National Transportation Safety Board
NORAC	Northeast Operating Rules Advisory Committee
PTC	positive train control
RWIC	roadway worker-in-charge
RWP	roadway worker protection
SSSWP	site-specific safety work plan
TAW	train approach warning

Executive Summary

On April 24, 2018, about 8:58 a.m. local time, northbound Amtrak train 86 struck and killed an Amtrak rail gang watchman near the Bowie State Train Station in Bowie, Maryland. The accident occurred on main track 1 at milepost 119.2 on the Philadelphia to Washington line, located on Amtrak's Northeast Corridor. At the time of the accident, main track 2 was out of service under a continuous track outage for track maintenance, and the adjacent tracks immediately to the east and west of main track 2 (main tracks 1 and 3, respectively) were in service for train movements. Three watchmen were protecting the roadway workers and watching for trains moving on adjacent tracks to warn workers of approaching trains. One watchman was positioned near the boarding platform, another was positioned in a nearby curve, and the third watchman was positioned toward the end of the curve, near a work gang of welders. The third watchman was the employee struck by the train. No passengers or crewmembers on Amtrak train 86 were injured.[1]

Amtrak train 86 departed Washington, D.C.'s Union Station about 8:40 a.m., destined for New York's Penn Station. The train was authorized to operate on main track 1 at maximum authorized speeds between 105 and 110 mph. The accident occurred when Amtrak train 86 entered the work zone. Immediately before Amtrak train 86 arrived at the work zone, Maryland Area Rail Commuter train 421 was traveling southbound through the work zone on main track 3, preparing to service the southbound passenger platform at the Bowie State Train Station. When Amtrak train 86 passed the Bowie State Train Station on main track 1, the engineer noticed that the rail gang watchman was standing too close to the track's edge, facing the roadway workers on main track 2 and the passing Maryland Area Rail Commuter train on main track 3. He was not looking toward Amtrak train 86's approach and did not respond to the horn from the train nor the warnings from the other watchmen. The engineer applied emergency train braking, slowing the train to 98 mph, before striking and killing the rail gang watchman.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the Bowie accident was Amtrak's insufficient site-specific safety work plan for the Bowie project that (1) did not consider the multiple main tracks in a high noise environment and (2) did not provide the rail gang watchman with a safe place to stand with level footing and sufficient sight distance to perform his duties, which led the rail gang watchman to stand on an active track in a work zone in the path of Amtrak train 86. Contributing to this accident was Amtrak's decision to use train approach warning for roadway worker protection in lieu of the protections that could have been provided by the positive train control system.

[1] For more information, see the factual information and analysis sections of this report. Additional information can be found in the public docket for this National Transportation Safety Board (NTSB) accident investigation (case number RRD18FR006) by accessing the Accident Dockets link at www.ntsb.gov. For information about our safety recommendations, see the CAROL Safety Recommendation Database at the same website.

Safety Issues

- **Inadequate site-specific safety risk assessment.** Although Amtrak had developed a site-specific safety work plan for its maintenance project, an analysis of that plan revealed that Amtrak's safety risk assessment did not identify and mitigate obvious risks and dangers placed on roadway workers, specifically, watchmen being struck by trains and other on-track equipment in a high-density, high-decibel, high-speed, multiple main track work environment.

- **Unsafe train speeds in established work zones.** On the day of the accident, trains were permitted to operate at speeds up to 125 mph through the work zone. Amtrak's policy that permits the operation of trains at high speeds through work zones continued after the April 3, 2016, accident in Chester, Pennsylvania, in which a train collided with maintenance-of-way equipment, killing 2 people and injuring 39 others.

- **Ineffective roadway worker protection.** Although Federal Railroad Administration regulations and Amtrak policies permit the use of train approach warning to establish on-track protection for roadway workers, Amtrak's decision to use this form of protection in a high-risk area allowed roadway workers to be exposed to the dangers of simultaneous bidirectional train movements at speeds up to 125 mph. The decision to use train approach warning protection permitted trains to operate through the multiple main track work zone at high speeds, solely relying on the situational awareness of the watchmen to provide warnings to workers.

Findings

- None of the following were factors in the accident: (1) mechanical condition of the train; (2) train handling and warnings from the engineer of Amtrak train 86; (3) employee fatigue; (4) employee training; (5) rail gang watchman impairment from alcohol and other tested-for drugs; and (6) cell phone usage.

- The rail gang watchman was most likely standing on the crosstie ends to obtain stable footing and to improve the visibility between himself and the roadway workers, as well as to improve his ability to see approaching trains from the north.

- The rail gang watchman likely did not realize that he was in imminent danger from northbound Amtrak train 86 because his attention was focused on warning the rail gang of the approaching southbound Maryland Area Regional Commuter train.

- Amtrak's site-specific safety work plan did not consider all work zone hazards for roadway workers, including the watchmen, because it did not identify the specific hazards relating to the multiple track work zone, such as simultaneous train movements, steep ballast shoulders, high noise levels, and trains operating at high speeds.

- Had Amtrak required trains to approach at significantly slower speeds through the Bowie work zone, the rail gang watchman would have had more time to become aware of the approaching train and relocate to a place of safety.

- Train approach warning is a weak system of on-track safety that fails to protect roadway workers, including watchmen, in controlled track territory.

- Had Amtrak established working limits or speed restrictions on main tracks 1 and 3 that enabled the protections available under positive train control, rather than relying on the use of train approach warning, the accident may have been prevented.

Recommendations

The National Transportation Safety Board proposes the following new safety recommendations:

New Recommendations

To the Federal Railroad Administration:

Modify Title 49 *Code of Federal Regulations* Part 214 to prohibit the use of train approach warning in controlled track territory during planned maintenance and inspection activities. (R-21-3)

To Amtrak (National Railroad Passenger Corporation):

Modify your site-specific safety work plan to require all work zone hazards for roadway workers and watchmen be identified and mitigated, including hazards associated with multiple main track work zones. (R-21-4)

To Amtrak and all Class I Railroads:

Eliminate the use of train approach warning protection in controlled track territory during planned maintenance and inspection activities. (R-21-5)

Previous Recommendation Reiterated in this Report

The National Transportation Safety Board proposes reiterating the following safety recommendation:

To Amtrak:

Conduct a risk assessment for all engineering projects and use the results to issue significant speed restrictions for trains passing any engineering project that involves safety risks for

workers, equipment, or the traveling public, such as ballast vacuuming, as part of a risk-mitigation policy. (R-17-23)

This safety recommendation is classified "Open—Acceptable Response."

Previous Recommendation Reiterated and Classified in this Report

The National Transportation Safety Board proposes classifying the following safety recommendation:

To the Federal Railroad Administration:

Define when the risks associated with using train approach warning are unacceptable and revise Title 49 *Code of Federal Regulations* 214.329 to prohibit the use of train approach warning when the defined risks are unacceptable. (R-20-6)

This safety recommendation was previously classified "Open—Initial Response Received" on April 16, 2021. This recommendation is now classified "Open—Unacceptable Response."

1. Factual Information

1.1. Accident

On April 24, 2018, about 8:58 a.m. local time, northbound National Railroad Passenger Corporation (Amtrak) train 86 struck and killed an Amtrak watchman in Bowie, Maryland.[1] No passengers or crewmembers on Amtrak train 86 were injured. The accident occurred on main track 1 at milepost (MP) 119.2 on the Philadelphia to Washington line, located on Amtrak's Northeast Corridor, about 1,500 feet north of the Bowie State Train Station.[2] The accident occurred in three-track signal-controlled territory, with many curves, an active passenger train station, and maximum authorized speeds (MAS) up to 105 mph on main track 1 and 125 mph on main track 3.[3]

Scheduled maintenance work began on March 9, 2018, and main track 2, the center track in a multiple main track territory, was placed out of service under a continuous track outage between Bowie State, MP 120.5, and Grove, MP 112.4. Trains moving through the work zone were operating under the authority of two-way track signal indications and dispatcher control.[4] Three watchmen were positioned along the east side of main track 1 with instructions to use train approach warning (TAW) to protect the roadway workers and watch for trains on the two tracks in service that ran immediately adjacent to the working limits: main track 1 and main track 3, which were east and west, respectively, of main track 2.[5] Figure 1 shows the accident site, including the location of the three watchmen. The struck watchman (referred to in this report as the rail gang watchman) was positioned along main track 1 protecting a group of track welders working on main track 2. One watchman (referred to in this report as the platform watchman), was posted at the Bowie State Train Station platform; this position allowed him to detect trains approaching the working limits from the south on main tracks 1 and 3. The other watchman (referred to in this report as the middle watchman), was posted along the sloped ballast shoulder, about 800 feet north of the watchman posted at the Bowie State Train Station. From this location, the middle watchman had sufficient time to detect trains approaching the working limits from the north. The rail welding foreman positioned the rail gang watchman at MP 119.2, directly across from the rail welders and roadway maintenance machinery because there was additional noise due

[1] A *watchman* is designated by the roadway worker-in-charge (RWIC) and can be any member of the roadway worker work group who has received the proper training, which is offered annually.

[2] This location consists of three main tracks.

[3] *Maximum authorized speed* (MAS) is the highest speed permitted for the movement of trains permanently established by timetable/special instructions, general order, or track bulletin.

[4] Two-way track signal indication (Northeast Operating Rules Advisory Committee [NORAC] rule 261) allows trains to operate on the same track in both directions.

[5] (a) *Train approach warning* is a method of establishing on-track safety by warning roadway workers of the approach of trains in ample time for them to move to or remain in a place of safety. (b) *Working limits* refers to a segment of track with definite boundaries within which trains and engines may move only as authorized by the roadway worker in control of that segment of track.

to the equipment and the watchman would be in a better position to get the attention of the welders.[6] At this location he was about 660 feet north of the middle watchman.

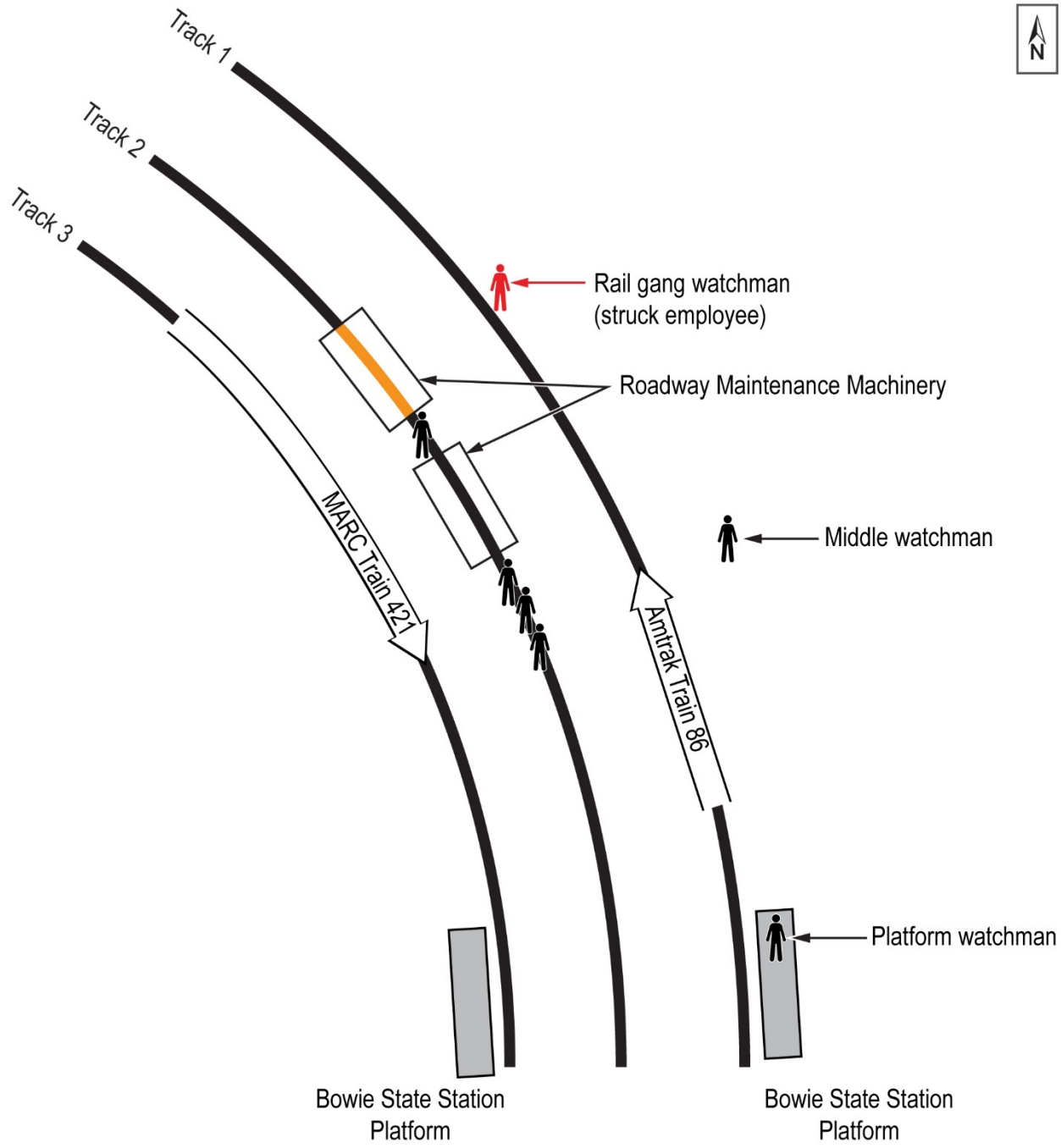

Figure 1. Graphic of accident site.

[6] *Roadway maintenance machinery* is a device powered by any means of energy other than hand power which is being used on or near railroad track for maintenance, repair, construction or inspection of track, bridges, roadway, signal, communications, or electric traction systems. Roadway maintenance machines may have road or rail wheels or may be stationary. Welding track and rail heaters are examples of roadway maintenance machinery.

Immediately before Amtrak train 86 arrived at the work zone, Maryland Area Rail Commuter (MARC) train 421 was traveling southbound on main track 3 and was scheduled to service the southbound passenger platform at the Bowie State Train Station at 8:58 a.m. As it approached the roadway workers working on main track 2, the train began to reduce its speed to service the station on main track 3. (See figure 1.) The watchmen, including the rail gang watchman, detected the approaching MARC train and alerted the roadway workers by blowing their hand-held air horns and raising their orange watchman's warning discs.[7] Work personnel told investigators that the roadway maintenance machinery operators then blew their equipment-mounted air horns to provide additional audible warnings.

As the last three cars of MARC train 421 were passing the roadway workers, northbound Amtrak train 86 approached the work zone on main track 1 at a speed of about 99 mph. The middle watchman later told the National Transportation Safety Board (NTSB) that he noticed the train but that its approach "caught him off guard" because there was no break between the audible alerts from the other watchmen for the MARC train, and he did not hear another horn to alert him. He then noticed that the rail gang watchman was standing on the edge of the main track 1 ties, fouling the track, and did not appear to be aware of the approaching northbound train.[8] The middle watchman said that he attempted to alert the rail gang watchman but could not get his attention. Forward-facing image recordings from Amtrak train 86 showed that the rail gang watchman was wearing a hooded sweatshirt with the hood up underneath his hard hat with his left shoulder facing Amtrak train 86.

According to event recorder data, as Amtrak train 86 entered the work zone, the engineer sounded the train's horn and warning bell in a series of five warning blasts, lasting between 1 and 5 seconds each, between 8:57:40 a.m. and 8:58:10 a.m. The engineer later told the NTSB that he noticed that the rail gang watchman was standing too close to the track's edge, facing the roadway workers on main track 2 and the MARC train on main track 3, so the rail gang watchman did not see the train's approach. The engineer initiated emergency train braking, slowing the train down to 98 mph, before striking and killing the rail gang watchman.

1.2. Site Description

The accident site consisted of three main line-controlled tracks that ran parallel in a timetable north-south direction.[9] The tracks were equipped with Amtrak's Advanced Civil Speed Enforcement System (ACSES), a positive train control (PTC) technology used on Amtrak

[7] Details of the job responsibilities of watchmen are found at Title 49 *Code of Federal Regulations* (*CFR*) 214.329 "Train Approach Warning Provided by Watchmen/Lookouts."

[8] *Fouling a track* means the placement of an individual or an item of equipment in such proximity to a track that the individual or equipment could be struck by a moving train or on-track equipment or, in any case, is within 4 feet of the field side of the near running rail.

[9] (a) *Controlled track* means track upon which the railroad's operating rules require that all movements of trains must be authorized by a train dispatcher or a control operator. (b) *Positive train control* (PTC) is an advanced train control system that uses communication-based and processor-based technology and must reliably and functionally prevent train-to-train collisions, overspeed derailments, incursions into established work zone limits, and movements of trains through switches in the wrong position. (c) *Timetable direction* refers to the geographical origin and termination locations of the trains. Often the track will be oriented on an opposing compass direction.

properties.[10] The tracks are geographically situated east to west with main track 1 to the east and main track 3 to the west. (See figure 1.)

Trains operating on main track 1 were under the movement authority of a permanent speed restriction of 105 mph between MP 121.0 and MP 119.0. Train speeds could increase to 110 mph between MP 119.0 and MP 118.4, north of the accident location. Trains operating on main track 3 had a MAS of 125 mph. Trains operating through the work zone were under the authority of two-way track signal indications and dispatcher control. In multiple track territories, trains may operate on any track, at any time, and in any direction. There were no established work zone speed restrictions for trains operating on main tracks 1 and 3 through the work zone.

1.3. Work Project

On March 9, 2018, main track 2 was placed out of service under a continuous 24-hour-per-day/7-day-per-week track outage between Bowie State, MP 120.5, and Grove, MP 112.4, so that the Amtrak maintenance-of-way roadway workers could perform production track undercutting and other maintenance and repair work of main track 2.[11]

According to interviews with the roadway workers, on the morning of the accident, the undercutter roadway workers met for roll call and job assignments. The track supervisor met with his foremen and assigned the undercutter surfacing foreman as the roadway worker-in-charge (RWIC) of the working limits. At 7:00 a.m., the roadway workers arrived at their work locations where the rail gang foreman (referred to as the employee-in-charge in this report), conducted an initial job safety briefing with the roadway workers.[12] This initial briefing was one of two required briefings.[13] The details of the briefing included information on the work location, personal protective equipment requirements, job duties, and Amtrak's safety rule of the day. All workers who were in attendance acknowledged their understanding of the job safety briefing by signing the job briefing documentation sheet.

At 7:50 a.m., the employee-in-charge received a text message from the RWIC that included a copy of the Form D for track 2, which allowed the roadway work crew to control the track, along with a message granting the work gang permission to begin work.[14] About 8:00 a.m., the employee-in-charge conducted the on-track safety briefing with the roadway workers.[15] The focus

[10] Amtrak has activated the *Advanced Civil Speed Enforcement System* (ACSES) on the tracks it owns in the Northeast Corridor and on the Amtrak-owned portion of the Michigan line. ACSES, in combination with cab signaling, is a PTC cab-signaling system designed to prevent train-to-train collisions, protect against overspeed, and protect work crews with temporary speed restrictions. It meets the Federal Railroad Administration's (FRA) requirements of a PTC system.

[11] (a) The accident occurred in the south working limits of the undercutter project. (b) An *undercutter* is an on-track machine that removes ballast from beneath the track so it can be cleaned.

[12] *Employee-in-charge* is an employee responsible for a work group under the overarching authority of the RWIC.

[13] Title 49 *CFR* 214.315 "Supervision and Communication."

[14] *Form D* is a form that grants the RWIC authority of the track, rather than the dispatcher. It basically provides the name of a contact person with authority of the track in case of an emergency. Although main track 2 was under a continuous outage, Amtrak's internal processes required that a Form D be submitted on a daily basis.

[15] *On-track safety* means a state of freedom from the danger of being struck by a moving railroad train or other railroad equipment, provided by operating and safety rules that govern track occupancy by personnel, trains, and equipment.

points of this briefing included the track outage number, protective limits and type of on-track safety for main track 2, adjacent track speeds, adjacent track on-track protection, total number of needed watchmen, and the predetermined place(s) of safety.[16] All roadway workers who were in attendance, including the rail gang watchman, acknowledged their understanding of the on-track safety briefing by signing the on-track safety briefing documentation sheet.

1.4. Site-Specific Safety Work Plan

In March 2018, Amtrak developed a 16-page site-specific safety work plan (SSSWP) for the Bowie project in collaboration with management, supervisors, maintenance employees, and the safety department. The SSSWP's objective was to identify existing or potential hazards and determine how best to eliminate, control, or minimize all identified hazards to an acceptable level of risk.

One of the hazards identified in the SSSWP for the Bowie project was "On-Track Protection." The mitigation for this identified hazard was to "comply with all RWP [roadway worker protection] rules and procedures." However, the SSSWP did not contain any detailed language about the RWP rules and procedures for the work site or the type of on-track safety to be used for adjacent on-track protection. (See section 1.8 for more information on the RWP rule.) The SSSWP did specifically address the undercutting between MP 120.5 and MP 112.2, stating that the project was starting in "hot spot" territory, where extra watchmen would be required to effectively provide the required RWP protection to the roadway workers.

Amtrak uses the term "hot spots" to identify locations along the railroad where additional on-track safety is required due to watchmen line-of-sight issues, obstructions, work zone characteristics, close clearing/no clearing points, and work zone noise levels. The SSSWP did not define and provide guidance on what the "hot spots" were in the Bowie work zone, the risks to roadway workers when working within this "hot spot" territory, or the risk mitigations to implement when working within the "hot spot" territory. Moreover, in 2014, some 4 years before this accident, Amtrak removed all training on "hot spots" from its RWP curriculum, and in 2017, Amtrak removed all references of "hot spot" from its RWP manual. Although not defined, the term is referenced within the Bowie undercutter project SSSWP and Amtrak's job safety and on-track job safety briefing forms.

When the NTSB interviewed the RWIC, he was asked whether he requested foul time for the work zone. Foul time is a method of establishing working limits on controlled track in which a roadway worker is notified by the train dispatcher or control operator that no trains will operate within a specific segment of controlled track until the roadway worker reports clear of the track, as prescribed in Title 49 *Code of Federal Regulations* (*CFR*) 214.323 "Foul Time." (Working limits are further discussed in section 1.8.3.) The RWIC indicated that, because it was rush hour, he would not have been granted foul time for the work zone at the time of the accident. The RWIC further elaborated that the time between trains, the length of the work zone (8 miles), and the

[16] A *predetermined place of safety* is the specific location that a roadway worker must occupy upon receiving a watchman's warning of approaching train movements on a track.

MARC train stops within the working limits would have hindered his ability to be granted foul time.

1.5. Work Zone Hazards

1.5.1. Physical Environment

During an examination of the accident scene, the NTSB noted that the ballast shoulder was steep at the location where the rail gang watchman was posted and did not provide stable footing.[17] Figure 2 shows the work environment. The NTSB asked the platform watchman about the rail gang watchman's position on the steep ballast. The platform watchman indicated that, in general, it was difficult to find stable footing anywhere along the steep ballast shoulder throughout the work zone.

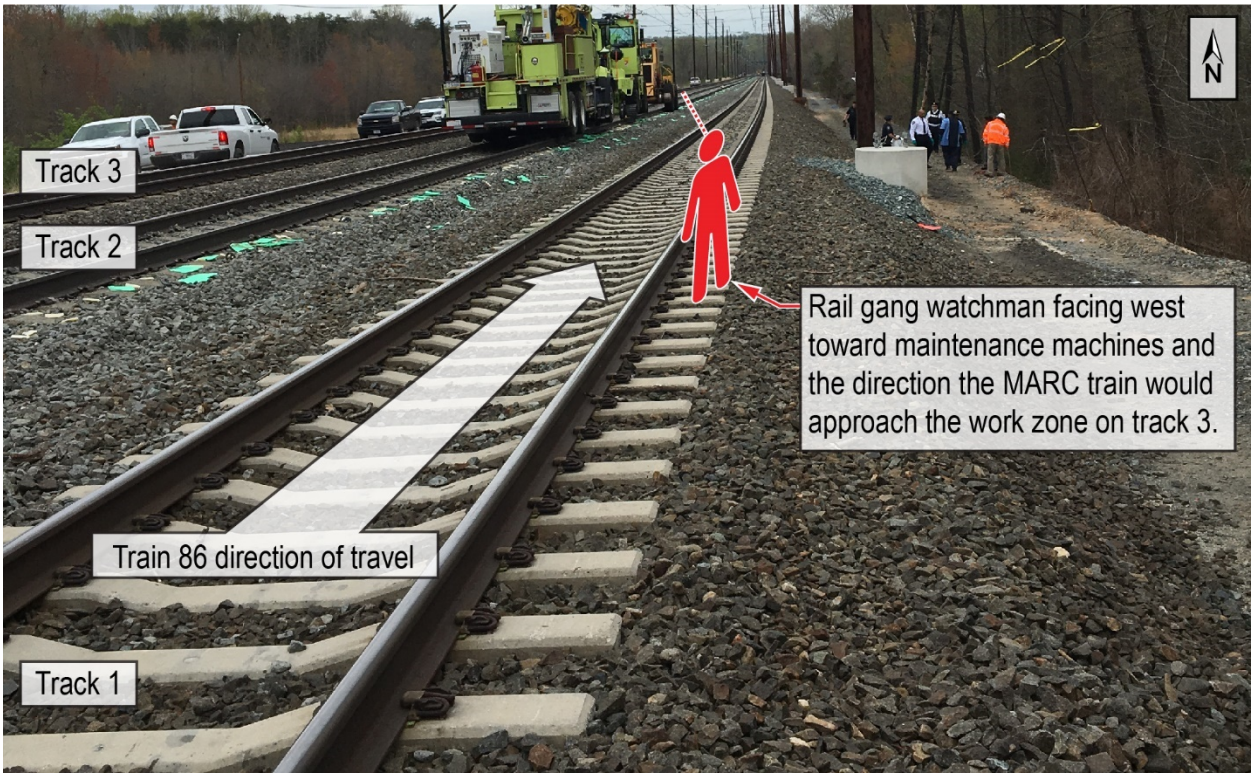

Figure 2. Photograph of the accident area, facing north.

The middle watchman indicated that the steep ballast shoulder was uncomfortable to stand on while watching for trains. The slope was steep enough that standing on the rocks that made up the ballast caused unstable footing.

Another roadway worker, who at times performed watchman duties, told investigators that near where the accident occurred, he felt it was necessary to stand right on the edge of the ties

[17] *Ballast* is material selected for placement on the roadbed, usually crushed stone, for the purpose of holding the track in line and at surface. It is applied to the roadbed to hold track to proper alignment.

because the steep ballast slope made it too difficult to safely stand and properly watch for trains. He also suggested to the NTSB that watchman platforms be built to reduce the safety hazards of unstable footing. Another employee stated that when watching for trains, he often found it necessary to move and pack the ballast around with his feet to make "step like" indentations in the steep ballast slope. He stated that when a train approached, he usually would go behind a catenary pole for added protection due to the flying debris and dust that the train kicked up.[18]

1.5.2. Sound Levels at the Time of the Accident

The middle watchman provided his perspective to the NTSB about sound levels at the time of the accident. Noises generated from the passing train horns, roadway maintenance machine horns, and air horns from the platform watchman and middle watchman were prevalent. The middle watchman reported that he was caught "off guard" when he saw Amtrak train 86 coming from the south because he did not hear the platform watchman blow his horn. He said that the watchmen were still blowing their horns for the MARC train that had entered the work zone from the north, but he did not hear another horn to alert everyone to the second train approaching from the south. He said that when he noticed Amtrak train 86 entering the area, he sounded his horn in an attempt to get the attention of the rail gang watchman to his north. The middle watchman indicated that it was possible that the struck watchman did not hear his horn, which was his only means of getting his attention.

1.6. Amtrak Train 86

Amtrak train 86, a Northeast Regional Direct train, departed Washington, D.C.'s Union Station about 8:40 a.m. on the day of the accident, destined for New York's Penn Station. It consisted of two electrified locomotives and eight passenger railcars.

1.7. Personnel Information

1.7.1. Rail Gang Watchman

The rail gang watchman was hired by Amtrak in July 2017. He attended a 2-week new-hire employee training program in Wilmington, Delaware, between July 31 and August 11, 2017. The training program instructed new-hire employees on basic railroad safety rules and instructions, including Amtrak-required safety training such as electrical safety near catenary tracks, initial RWP training, training on Federal Railroad Administration (FRA) regulations, and bridge worker safety.

The rail gang watchman completed his initial training on Northeast Operating Rules Advisory Committee (NORAC) operating rules on October 31, 2017, and was requalified on February 16, 2018. He was also requalified on RWP on February 17, 2018. He started Amtrak's initial watchman certification training program on November 6, 2017, completing the certification training on November 15, 2017. He received his watchman qualification certification on

[18] A *catenary pole* is an upright support pole that supports the weight of Amtrak's overhead electrified system. They are placed every 265 feet on the Northeast Corridor.

November 29, 2017. Testing records show that Amtrak conducted and documented 11 random, unscheduled efficiency test examinations on safety rules for the rail gang watchman between September 2017 and March 2018, and he passed all of them.

1.7.1.1. Sleep/Wake/Work Hours

The rail gang watchman was working Monday through Thursday between 6:00 a.m. and 4:30 p.m., with an unpaid 30-minute lunch break. The rail gang watchman had 3 consecutive regular days off on Friday, Saturday, and Sunday, which he did not work. Table 1 shows his work hours in the 8 days before the April 24 accident.

Table 1. Rail Gang Watchman work history hours.

Date	Straight Time Hours	Overtime Hours	Total Hours
April 16, 2018	10.00	4.00	14.00
April 17, 2018	10.00	6.00	16.00
April 18, 2018	10.00	0	10.00
April 19, 2018	10.00	0	10.00
April 20, 2018	Day off		
April 21, 2018	Day off		
April 22, 2018	Day off		
April 23, 2018	10.00	1.50	11.50

1.7.1.2. Postaccident Toxicology Testing

The FRA conducted postaccident toxicology testing on the rail gang watchman. The testing screened for substances including amphetamines, barbiturates, benzodiazepines, cocaine, alcohol and marijuana metabolites, methadone, methaqualone, MDA-analogues, opiates, 6-acetylmorphine, oxycodone, opiates, phencyclidine, and propoxyphene. The results were negative for the presence of these drugs.

1.7.1.3. Cell Phone Usage

Forward-facing image recording from Amtrak train 86 revealed no evidence to suggest that the rail gang watchman was talking on or using his cell phone or any other type of electronic device when he was struck by the train.

1.7.2. Amtrak Train 86 Engineer

The engineer of Amtrak train 86 was hired in 2003 after previously working as an engineer for CSX Transportation. A review of his training records shows that he was trained on specialized Amtrak NORAC operating rules/Northeast Corridor special instructions and the characteristics of the route and was certified as a passenger locomotive engineer under 49 *CFR* Part 240 "Qualification and Certification of Locomotive Engineers" regulations. Amtrak efficiency testing

records show that the engineer received both observational and written tests on April 19, 2018. He successfully completed the on-track obstructions and restricted speed test sections.[19]

1.7.2.1. Hours-of-Service

NTSB investigators reviewed about 2 months of the train engineer's work history and hours-of-service records to determine his compliance with the hours-of-service requirements in 49 *CFR* Part 228.[20] The engineer was regularly scheduled to work Monday through Friday, with rest days on Saturday and Sunday, which he did not work. Table 2 shows his work hours in the 8 days before the April 24 accident.

Table 2. Amtrak train 86 engineer work history hours.

Date	Straight Time Hours	Overtime Hours	Total Hours
April 16, 2018	8.00	4.00	12.00
April 17, 2018	8.00	3.01	11.01
April 18, 2018	8.00	3.01	11.01
April 19, 2018	8.00	3.01	11.01
April 20, 2018	8.00	3.01	11.01
April 21, 2018	Day off		
April 22, 2018	Day off		
April 23, 2018	8.00	3.05	11.05

1.8. Roadway Worker Protection

FRA's RWP regulation (49 *CFR* Part 214, Subpart C) requires railroads to have an on-track safety program that includes rules, procedures, training, and equipment to be used to protect roadway workers.[21] The rule states that railroads should develop and adopt procedures to protect their roadway workers from being struck by trains and other on-track machinery. It also requires the roadway workers to follow those rules and procedures to protect themselves and others. Amtrak's on-track safety program manual contained sections concerning on-track safety protections, definitions, and procedures for implementation, which will be discussed later in this report.

1.8.1. Amtrak Special Instructions

Although not mandated for use by Amtrak management, work zone speed restrictions are an option RWICs can use for on-track safety. At the time of the accident, Amtrak Special Instruction 175.S2 directed train dispatchers to issue an 80-mph slow-by speed restriction to trains operating next to where roadway workers and track machinery were performing work. It also directed train dispatchers to always slow trains as they passed by work zones where a track laying

[19] *Restricted speed* is a method of operation that permits stopping within one-half the range of vision, and includes specific provisions for controlling the movement, maintaining vigilance, and MAS. NORAC Rule 80 governs movements made at restricted speed and requires that trains operate at speeds no greater than 20 mph while under restricted speed.

[20] Title 49 *CFR* 228.11 "Hours of Duty Records."

[21] Title 49 *CFR* 214.7 "Definitions" includes watchmen in the list of employees considered to be roadway workers.

machine or an undercutter were working on an out-of-service track. However, this instruction did not automatically apply and had to be specifically requested by the RWIC. Although the speed restriction was available for the work zone at the time of the accident and was mentioned in the project's SSSWP, it was not implemented.[22]

1.8.2. Train Approach Warning

FRA regulations and FRA's *Track and Rail and Infrastructure Integrity Compliance Manual*, Volume 3, Chapter 3, require that roadway workers fouling track outside of working limits be given warning of approaching trains by one or more watchmen (FRA 2018).[23] For TAW protection to be effective, the warning must be given in sufficient time to allow each roadway worker, including watchmen, to move to and occupy a previously arranged place of safety at least 15 seconds before the train's arrival. The minimum 15-second warning time is calculated by using the MAS of the trains operating through that location. Furthermore, the place of safety to be occupied upon the approach of a train may not be on a track, unless working limits are established on that track. The manual outlines specific requirements for watchmen and states that watchmen must use distinctive and clear signals to all roadway workers, including other watchmen, warning that a train or other on-track equipment is approaching. The watchmen assigned to provide TAW are instructed to devote full attention to detecting the approach of trains and communicating a warning and cannot be assigned any other duties while functioning as watchmen. The manual also states that every roadway worker who is assigned the duties of a watchman must be trained, qualified, and designated in writing by the employer to serve as a watchman in accordance with the provisions in 49 *CFR* 214.349 "Training and Qualification of Watchmen/Lookouts." Furthermore, the manual states that the watchmen should communicate the warnings in a way that can be detected by the roadway workers regardless of noise or work distractions, and that does not require the roadway workers to be looking in one particular direction (FRA 2018).

1.8.3. Working Limits

Another form of on-track protection for roadway workers are working limits. According to 49 *CFR* 214.7 "Definitions," working limits means a segment of track with definite boundaries established upon which trains and engines may move only as authorized by the RWIC having control over that defined segment of track. When the RWIC establishes working limits, the authority to move trains is removed from the train dispatcher and granted to the roadway worker. When working limits are established, the dispatcher makes an entry into the dispatching system to show that segment of track is out of service, which activates the protections implemented by PTC (see next section) or redundant signal protections. Working limits were not established for main tracks 1 or 3 at the Bowie work zone; they were in place for main track 2 only.

1.8.4. Positive Train Control

The Rail Safety Improvement Act of 2008 mandated that all Class I and passenger railroads fully implement PTC systems. That requirement was enacted nationwide on December 31, 2020;

[22] For more information on the Bowie project's SSSWP, see section 2.2.
[23] Title 49 *CFR* 214.329 "Train Approach Warning Provided by Watchmen/Lookouts."

however, this train and track were equipped with ACSES (a PTC system) before the date of this accident. PTC is a technology-based system to prevent train accidents caused by human error, including train-to-train collisions, overspeed derailments, incursions into established working limits, and movements of trains through a switch left in the wrong position.

1.9. Postaccident Inspections

Amtrak train 86 was terminated at the accident site so that event and image recorder downloads and mechanical inspections could be carried out. FRA motive power and equipment inspectors performed a comprehensive inspection of Amtrak train 86. All mechanical systems were inspected, including the braking system, horn, headlight, and auxiliary lights (ditch lights). FRA test records were also reviewed. All systems inspected were found to be working as intended and in compliance with federal regulations. Damage estimates and materials replacement costs for Amtrak train 86 were estimated at $900.

An FRA signal and train control inspector examined the on-board cab signal system and the ACSES PTC system on the lead locomotive for proper operation and compliance with FRA regulations. The inspector also reviewed FRA-required test records. Both systems were working as intended and in compliance with federal regulations.

Once the initial inspection of Amtrak train 86 was complete, it was released to return to Washington, D.C.'s Ivy City Maintenance Facility for additional investigative and mechanical compliance inspections by FRA and Amtrak investigators. The inspections and a review of mechanical records indicated that no mechanical defects were found on the consist of Amtrak train 86.

1.9.1. Sight Distance Observations

The NTSB performed sight distance observations in the area of the accident to determine the struck watchman's sight distance and warning time for trains approaching from the north on main tracks 1 and 3, both in the position he was standing and at the bottom of the east ballast shoulder, away from the track.[24]

Where the rail gang watchman was standing on main track 1, he would have had a sight distance of 4,770 feet looking north. For main track 1, this equates to about 30 seconds of warning time for trains approaching from the north and operating at a MAS of 105 mph. For main track 3, this equates to about 26 seconds of warning time for trains approaching from the north and operating at a MAS of 125 mph. Because advance watchmen were located south of the rail gang watchman and were responsible for alerting the rail gang watchman to trains approaching from the south, the total warning time for the rail gang watchman for trains approaching from the south would have been greater than that which his direct sight distance would have allowed; the total warning time was greater than required by FRA regulations.

[24] Title 49 *CFR* 214.329 "Train Approach Warning Provided by Watchmen/Lookouts" and Amtrak's *Roadway Worker Protection Manual* Rule 329.

The NTSB also estimated the rail gang watchman's sight distance and warning time had he been standing at the bottom of the east ballast shoulder by the access road and in line with the catenary poles. When standing at this location and looking north, the left-hand curves and the catenary poles on main track 1 obstructed the line-of-sight distances for both main tracks 1 and 3. This reduced the sight distance to about 3,445 feet for main track 1, equating to about 22 seconds of warning time for trains approaching from the north, operating at the MAS of 105 mph. For main track 3, roadway workers would have had about 18 seconds of warning time for trains approaching from the north.

1.10. Postaccident Actions

Amtrak made several changes to its work zone processes in response to this accident. These actions include:

- Revised Special Instruction 175-S2 "80 mph slow-by" speed restriction to a "60 mph slow-by" speed restriction for trains operating on tracks immediately adjacent to a track laying machine or undercutter. These speed restrictions originally applied only to the areas immediately adjacent to the track laying machine or undercutter, not the entire work zone. The speed restriction now covers the entire work zone, rather than specific locations of work equipment.

- Evaluated Amtrak safety risk management processes through working groups that include management and field personnel. These groups identified the greatest risks in work location and scope. Safety risks identified in this process include: RWP, exposure to trains (both high speed and frequency), electrical hazards, and equipment collisions. Safety risk findings are now being reported to Amtrak's Executive Safety Council and operating department heads.

- Revised and reintroduced the "Hot Spots" guide. The revisions included a sight distance chart to aid roadway workers and watchmen in sight assessments when using TAW. This manual was not provided to employees between 2014 and 2018. Amtrak also included a job briefing requirement to guide employees in properly performing the sight distance evaluation process. This information is now included in an SSSWP.

- Ordered additional portable aerial stands. Because it considers watchman aerial stands useful to preventing accidents such as this one, Amtrak ordered more portable aerial stands to supplement the 20 that it had in stock at the time of a December 19, 2019, NTSB Record of Conversation between NTSB and Amtrak.

2. Analysis

2.1. Introduction

On April 24, 2018, about 8:58 a.m. local time, northbound Amtrak train 86 struck and killed an Amtrak watchman in Bowie, Maryland. The train strike occurred on main track 1, about 1,500 feet north of the Bowie State Train Station on Amtrak's Northeast Corridor. At the time of the accident, the watchman was fouling the track while providing TAW to a group of rail welders working on main track 2, the center track of a three-track territory. Working limits were established on main track 2, which had been placed out of service under a continuous exclusive track outage for maintenance on March 9, 2018. When the accident occurred, two trains were traveling in opposite directions simultaneously through the work zone on main tracks 1 and 3.

This analysis discusses the accident and the following safety issues:

- **Inadequate site safety risk assessment.** (See section 2.2.)
- **Unsafe train speeds in established work zones.** (See section 2.3.)
- **Ineffective roadway worker protection.** (See section 2.4.)

Having completed a comprehensive review of the circumstances that led to the accident, the investigation established that the following factors did not contribute to its cause:

- *Mechanical condition of the train.* FRA motive power and equipment inspectors performed a comprehensive inspection on Amtrak train 86. The inspectors found that all mechanical systems inspected, including the train's braking system, horn, headlight, and auxiliary lights, were working as intended and in compliance with federal regulations.

- *Train handling and warnings.* A review of the event recorder data from Amtrak train 86 revealed that the engineer was operating the train at 99 mph, which was below the MAS for main track 1 and that the engineer provided a series of five 1-5 second warning blasts of his horn and bell between 8:57:40 a.m. and 8:58:10 a.m. to alert the roadway workers as the train traversed through the work zone.

- *Sight distance.* NTSB investigators determined that the rail gang watchman's sight distance to detect approaching trains from the north was appropriate and consistent with the minimum requirements outlined in 49 *CFR* 214.329 "Train Approach Warning Provided by Watchmen/Lookouts."

- *Employee fatigue.* The work/rest histories for both the rail gang watchman and the engineer of Amtrak train 86 indicated that both employees had adequate opportunity for rest in the days before the accident.

- *Employee training.* The training records for the rail gang watchman and the engineer of Amtrak train 86 indicate that both employees were trained on Amtrak's railroad operating rules (NORAC) and all specialized training specific to their job.

- *Impairment from drugs and alcohol.* Postaccident toxicology testing on the rail gang watchman were negative for drugs and alcohol.

- *Cell phone use.* Forward-facing image recording from Amtrak train 86 revealed no evidence to suggest that the rail gang watchman was talking on or using his cell phone or any other type of electronic device when he was struck by the train.

Thus, the NTSB concludes that none of the following were factors in the accident: (1) mechanical condition of the train; (2) train handling and warnings from the engineer of Amtrak train 86; (3) employee fatigue; (4) employee training; (5) watchman impairment from alcohol and other tested-for drugs; and (6) cell phone usage.

2.2. Site-Specific Safety Work Plan

Forward-facing image recordings from Amtrak train 86 show that, in the moments before he was struck by the train, the rail gang watchman was standing in the foul of main track 1 looking toward the MARC train. According to the middle watchman, the rail gang watchman was standing on the outside of the curved track on the ends of two crossties (a flat surface), just inches away from the track.

The forward-facing image recordings from Amtrak train 86 appeared to indicate that the rail gang watchman had a hood pulled up over his head and under his hardhat, which would have impaired his hearing and possibly his range of vision. He was holding up an orange watchman's warning disc with his left hand and facing west in the direction of the southbound MARC train that had entered the work zone on main track 3.

The rail gang watchman took a large risk when he assumed a position on the two crossties on a live track. To understand why the rail gang watchman placed himself in the foul of a live track, the NTSB interviewed four Amtrak employees who have worked as watchmen. Most of the watchmen suggested that he likely stood on the crosstie ends for better stability, as the sloped shoulder ballast along the east side of main track 1 was unstable and difficult to stand on. The slope of the shoulder ballast along the west side of main track 1 was steep and consisted of loose, slippery ballast, which created a tendency for the ballast to shift under the workers' feet and caused them to slide downhill. The NTSB notes that watchmen are expected to maintain one position for extended periods of time and require safe and adequate footing to do so; the crossties provided more stability than the steeply sloped ballast. Moreover, the rail gang watchman, when standing on the crossties on main track 1, had a better view of the roadway workers on main track 2 and trains approaching from the north on main tracks 1 and 3, compared with the view he had standing on or at the bottom of the sloped wayside. Thus, the NTSB concludes that the rail gang watchman was most likely standing on the crosstie ends to obtain stable footing and to improve the visibility between himself and the roadway workers, as well as to improve his ability to see approaching trains from the north.

Several roadway workers described the work site as noisy due to the construction work and the equipment that was repairing the track. The workers also indicated that the MARC train crew had activated the train's horn and that several equipment operators had activated the horns on their rail equipment. Additionally, as the southbound MARC train approached and passed through the work zone from the north, the watchmen were providing approaching train warnings to the workers for the MARC train.

The middle watchman positioned to the south of the rail gang watchman reported that he could not hear the platform watchman's horn when the Amtrak train was approaching. When he detected the approaching Amtrak train and tried to get the attention of the rail gang watchman using a handheld air horn, he could not attract the attention of the rail gang watchman, who continued to look in the direction of the passing MARC train on main track 3. The noisy environment necessitated the roadway workers to be vigilant and conduct visual scans to be alerted to oncoming trains from both directions. The NTSB concludes that the rail gang watchman likely did not realize that he was in imminent danger from northbound Amtrak train 86 because his attention was focused on warning the rail gang of the southbound MARC train.

Before starting the project, Amtrak completed a SSSWP, a document intended to identify existing or potential hazards and determine how best to eliminate, control, or minimize all identified hazards to an acceptable level of risk. However, the SSSWP did not explicitly contain a discussion of the safest forms of on-track protection for multiple-track environments, which the NTSB believes is concerning given the critical role on-track safety has in protecting roadway workers from being struck by a train. The SSSWP instructed roadway workers to follow RWP rules; however, it did not provide instruction on how to safely comply with those rules. There was no discussion in the SSSWP for this project on the speed of trains moving on adjacent tracks, simultaneous train movements on adjacent tracks, or the unstable ballast conditions and the impact of these on the watchmen's ability to successfully perform their duties.

The SSSWP identified "on-track protection" as a hazard, but the instructions to control or eliminate the hazard was simply to "comply with roadway worker protection rules and procedures." Amtrak's safety risk assessment did not identify or define the specific hazards related to on-track safety at this site. Moreover, the SSSWP failed to identify a safe and sufficient system of on-track safety to adequately protect roadway workers from being struck by a train. For example, the hazard assessment worksheet evaluated general safety topics, such as fall protection and working in confined spaces, but contained little evaluation of the safety risks encountered within the multiple track work zone, such as simultaneous train movements; steep ballast shoulders; high noise levels; and trains operating at high speeds.

Amtrak's SSSWP did not ensure that the locations where the watchmen would be working were safe and effective. Given the multiple-track, high-speed environment, the position and safety of the watchmen should have been a priority in the project safety planning. As discussed in section 1.4, the term "hot spots" was used in the SSSWP, but it was not defined or adequately explained, nor was additional information provided to workers in the 4 years before the accident. Because "hot spots" identify locations where additional on-track safety is required, the term should have been clearly defined in the SSSWP and remedies put in place to address the risks associated with this hot spot.

The rail gang watchman was in an unsafe work position and was responsible for detecting approaching trains moving in opposite directions on multiple tracks in a noisy environment. Watchmen are critical in providing on-track protection, and the conditions under which they are working must not hamper their ability to continuously sustain attention, perceive threats, process information, and act. Watchmen are roadway workers and cannot properly protect others if they are not properly protected themselves. The NTSB concludes that Amtrak's SSSWP did not consider all work zone hazards for roadway workers, including the watchmen, because it did not identify the specific hazards relating to the multiple track work zone, such as simultaneous train movements, steep ballast shoulders, high noise levels, and trains operating at high speeds. Therefore, the NTSB recommends that Amtrak modify its SSSWP to require all work zone hazards for roadway workers and watchmen be identified and mitigated, including hazards associated with multiple main track work zones.

2.3. Train Speeds in Work Zones

At the time of the Bowie, Maryland, accident, trains were allowed to operate at MAS up to 125 mph on main track 3 and speeds up to 110 mph on main track 1. When Amtrak train 86 neared the Bowie State Train Station, it was traveling northbound through the work zone on main track 1 at 99 mph, 6 mph below the posted 105 mph speed limit. The engineer placed the train in emergency braking when he saw the rail gang watchman, which slowed the train to 98 mph. Had Amtrak train 86 been operating at restricted speed (no greater than 20 mph) through the entire work zone, the rail gang watchman would have had significantly more time (50 seconds) to detect the signal from the watchman to the south that there was an oncoming train and move to a place of safety. Moreover, under NORAC Rule 80, restricted speed requires engineers to operate at a speed where they can be prepared to stop in advance of an obstruction on the track. Thus, the Amtrak engineer would have been able to bring the train to a safe stop upon observing the rail gang watchman fouling the track.

The SSSWP Amtrak produced prior to the Bowie accident was inadequate and did not identify and mitigate all anticipated risks, such as the speeds of the trains, as noted above. The NTSB found in its investigation of an April 3, 2016, collision of an Amtrak train with maintenance-of-way workers and equipment in Chester, Pennsylvania, that Amtrak did not prepare a SSSWP before the initiation of that project and concluded that had Amtrak instructed dispatchers to operate trains at significantly slower speeds through the Chester work zone, the severity of the accident would have been diminished (NTSB 2017). As a result, on December 28, 2017, the NTSB issued Safety Recommendation R-17-23 to Amtrak.

> Conduct a risk assessment for all engineering projects and use the results to issue significant speed restrictions for trains passing any engineering project that involves safety risks for workers, equipment, or the traveling public, such as ballast vacuuming, as part of a risk-mitigation policy. (R-17-23)

Safety Recommendation R-17-23 is on the NTSB's 2021-2022 Most Wanted List of Transportation Safety Improvements in the issue area "Improve Rail Worker Safety."

In response to this recommendation, effective June 25, 2018, Amtrak expanded existing special instructions regarding speed restrictions for specific situations in work zones to include a

speed reduction to 60 mph past a continuous and planned track outage when undercutters or track laying machines were being used. Amtrak also contracted with an engineering firm to conduct a risk assessment and evaluate its TAW procedures. On August 13, 2019, the engineering firm's study identified safety enhancements for all of Amtrak's maintenance-of-way activities, which Amtrak adopted. Among these enhancements, TAW works zones were addressed with a slow-order process that decreased train speeds entering TAW work zones from 80 mph to no greater than 60 mph, which also allowed for a lower speed restriction in higher-risk locations.

On February 19, 2020, the NTSB replied to the FRA that a risk assessment of TAW speed restrictions must consider sight distances and the resulting warning time for work crews and that our review of Amtrak's risk assessment and evaluation of its TAW procedures did not find any analysis of available sight distances and resulting warning times for work crews nor any guidance for how to determine when a lower slow-by speed is needed.

On August 23, 2020, Amtrak replied that reductions in speed below 60 mph allow a minimum of 15 seconds between when a train is first sighted and when it reaches the work site, as mandated by the FRA in 49 *CFR* 214.329. On May 13, 2021, the NTSB replied that the sight distance calculations did not appear to include time for factors such as mental processing and a worker navigating terrain before reaching the preplanned position of safety. The NTSB also said that the reduction of train speed from 80 mph to 60 mph was insufficient and that it was imperative to further reduce train speed as well as provide additional watchmen/lookouts to ensure the safety of roadway workers. The NTSB asked Amtrak to revise its risk assessment guidance for higher-risk work areas to mandate significantly slower train speeds than 60 mph. Safety Recommendation R-17-23, remained classified "Open—Acceptable Response."

Although reducing the speed to 60 mph would have resulted in an additional 7 seconds of warning time for the watchman, the NTSB is concerned that this speed reduction may still not allow enough time for roadway workers to be alerted to an oncoming train, process the information, and navigate terrain to reach a place of safety before the approaching train arrives at the roadway worker's location. This is particularly true in higher-risk areas such as the Bowie work zone where simultaneous train movements, steep ballast shoulders, and high noise levels are present. The NTSB concludes that had Amtrak required trains to approach at significantly lower speeds through the Bowie work zone, the rail gang watchman would have had more time to become aware of the approaching train and relocate to a place of safety. Although Amtrak produced a SSSWP for the Bowie project, it did not identify the need for reduced speeds, which would have provided additional safety benefits through the work zone. The NTSB believes that the circumstances of the accident in Bowie support the need for risk assessments that include significant speed restrictions, as recommended in Safety Recommendation R-17-23. Therefore, the NTSB reiterates Safety Recommendation R-17-23.

2.4. Roadway Worker Protection

Title 49 *CFR* 214.7 "Definitions" defines TAW as "a method of establishing on-track safety by warning roadway workers of the approach of trains in ample time for them to move to or remain in a place of safety." TAW relies critically upon watchmen to detect, recognize, and announce the approach of trains into the work site. In this accident, the rail gang watchman did not

detect the approach of the train, thus, the use of TAW did not provide sufficient on-track protection.

The effectiveness of TAW is predicated on human performance and rules compliance and relies on administrative controls. Multiple factors, including a noisy, challenging physical environment and high train speeds with multiple trains transiting the area from opposite directions, made TAW an ineffective choice for on-track safety protection. Prior NTSB reports identify that the use of TAW did not protect roadway workers, and this accident further demonstrates the failures of TAW (NTSB 2009, 2018, 2020). Title 49 *CFR* 214.329(e) states that "Watchmen/lookouts shall communicate train approach warnings by a means that does not require a warned employee to be looking in any particular direction at the time of the warning, and that can be detected by the warned employee regardless of noise or distraction of work." This portion of the TAW regulation was clearly not met in this accident because of the multiple tracks and a high-noise environment.

In the NTSB's investigation of a June 10, 2017, accident in Queens Village, New York, in which the foreman of a work crew for the Long Island Rail Road was killed when he stepped into the path of an oncoming train, the NTSB found that "train approach warning regulations do not ensure protection for roadway workers to inspect and work on tracks where trains are allowed to continue to operate (NTSB 2020)."[25] As a result of the Queens Village accident investigation, on May 14, 2020, the NTSB issued Safety Recommendation R-20-6 to the FRA.

> Define when the risks associated with using train approach warning are unacceptable and revise Title 49 *Code of Federal Regulations* 214.329 to prohibit the use of train approach warning when the defined risks are unacceptable. (R-20-6)

This recommendation applies to all uses of TAW in all territories and is on the NTSB's 2021-2022 Most Wanted List of Transportation Safety Improvements in the issue area "Improve Rail Worker Safety."

On April 21, 2021, the FRA replied that it disagreed with R-20-6. The FRA stated that the findings from the Queens Village accident, which were the basis for this recommendation, were faulty. The FRA said that roadway workers involved in the Queens Village accident did not comply with basic requirements of FRA regulations governing TAW because they failed to occupy or even discuss a predetermined place of safety from oncoming trains. Therefore, the FRA stated that it believed that these failures were the cause of the accident, not the decision to use TAW. The Bowie accident clearly illustrates the risks associated with using TAW in controlled track territory. Amtrak did not consider these various risks when they established TAW for the work zone, which included a multiple track location, high noise levels, and difficult footing for trackside watchmen. Despite these risks, 49 *CFR* 214.329 permitted the use of TAW.

In June 2018, the Fatality Analysis of Maintenance-of-Way Employees and Signalmen (FAMES) Committee issued a report that estimated that between 1997 and February 1, 2017, of the 55 roadway worker fatalities, 13 fatal accidents occurred where TAW was being used as the

[25] This and other previous investigations are discussed in greater detail in appendix C.

method of on-track safety, resulting in 16 fatalities (FAMES 2018).[26] The FAMES data showed that 12 of the 13 accidents occurred in locations where there were multiple tracks, such as the Bowie accident location.

As illustrated in earlier NTSB investigations, roadway worker fatalities continue to occur when TAW is used for on-track safety (NTSB 2009, 2018, 2020). Multiple breakdowns in safety observed in these accidents that used TAW protection included failures in communicating critical on-track safety information, providing correct information in job briefings, calculating sight distance assessments, positioning watchmen appropriately, and supplying required equipment. The NTSB concludes that TAW is a weak system of on-track safety that fails to protect roadway workers, including watchmen, in controlled track territory. Therefore, the NTSB reiterates Safety Recommendation R-20-6. Because the FRA was unresponsive to Safety Recommendation R-20-6, it is classified "Open—Unacceptable Response."

Further, TAW does not use working limits or speed restrictions and, therefore, circumvents the protections that would be provided by PTC in controlled track territory. For a PTC system to protect roadway workers, an RWIC of on-track safety for a work group must establish working limits with the train dispatcher.[27] When working limits are established, the PTC system prevents incursions into that segment of track. Alternatively, temporary speed restrictions can also provide protection. When a temporary speed restriction is placed on the track by the dispatcher, PTC enforces that speed restriction. Working limits were established for main track 2; however, neither working limits nor a speed restriction were established for main tracks 1 and 3. As previously discussed, in controlled track territory, the risk of roadway workers being struck by a train can be reduced by using working limits or speed restrictions, which would enable PTC protections. The NTSB concludes that had Amtrak established working limits or speed restrictions on main tracks 1 and 3 that enabled the protections available under PTC, rather than relying on the use of TAW, the accident may have been prevented. Therefore, the NTSB recommends that Amtrak and all Class I railroads eliminate the use of TAW protection in controlled track territory during planned maintenance and inspection activities. Because of the significant risk associated with using TAW in controlled track territories, the NTSB further recommends that the FRA modify 49 *CFR* Part 214 to prohibit the use of TAW in controlled track territory during planned maintenance and inspection activities.

[26] The FAMES Committee was formed by the FRA, in collaboration with railroad labor and management representatives, to form an ad-hoc committee to review roadway worker fatalities. FAMES is a voluntary, consensus-based committee focused on identifying risks, trends, and factors impacting roadway worker safety. FAMES focuses primarily on education and prevention and periodically issues findings and recommendations based upon its review of available safety data.

[27] Title 49 *CFR* 214.7 defines a *work group* as two or more roadway workers organized to work together on a common task.

3. Findings

3.1. Conclusions

1. None of the following were factors in the accident: (1) mechanical condition of the train; (2) train handling and warnings from the engineer of Amtrak train 86; (3) employee fatigue; (4) employee training; (5) watchman impairment from alcohol and tested-for drugs; and (6) cell phone usage.

2. The rail gang watchman was most likely standing on the crosstie ends to obtain stable footing and to improve the visibility between himself and the roadway workers, as well as to improve his ability to see approaching trains from the north.

3. The rail gang watchman likely did not realize that he was in imminent danger from northbound Amtrak train 86 because his attention was focused on warning the rail gang of the approaching southbound Maryland Area Regional Commuter train.

4. Amtrak's site-specific safety work plan did not consider all work zone hazards for roadway workers, including the watchmen, because it did not identify the specific hazards relating to the multiple track work zone, such as simultaneous train movements, steep ballast shoulders, high noise levels, and trains operating at high speeds.

5. Had Amtrak required trains to approach at significantly slower speeds through the Bowie work zone, the rail gang watchman would have had more time to become aware of the approaching train and relocate to a place of safety.

6. Train approach warning is a weak system of on-track safety that fails to protect roadway workers, including watchmen, in controlled track territory.

7. Had Amtrak established working limits or speed restrictions on main tracks 1 and 3 that enabled the protections available under positive train control, rather than relying on the use of train approach warning, the accident may have been prevented.

3.2. Probable Cause

The National Transportation Safety Board determines that the probable cause of the Bowie accident was Amtrak's insufficient site-specific safety work plan for the Bowie project that (1) did not consider the multiple main tracks in a high noise environment and (2) did not provide the rail gang watchman with a safe place to stand with level footing and sufficient sight distance to perform his duties, which led the rail gang watchman to stand on an active track in a work zone in the path of Amtrak train 86. Contributing to this accident was Amtrak's decision to use train approach warning for roadway worker protection in lieu of the protections that could have been provided by the positive train control system.

4. Recommendations

4.1 New Recommendations

As a result of this investigation, the National Transportation Safety Board makes the following new safety recommendations:

To the Federal Railroad Administration:

> Modify Title 49 *Code of Federal Regulations* Part 214 to prohibit the use of train approach warning in controlled track territory during planned maintenance and inspection activities. (R-21-3)

To Amtrak (National Railroad Passenger Corporation):

> Modify your site-specific safety work plan to require all work zone hazards for roadway workers and watchmen be identified and mitigated, including hazards associated with multiple track work zones. (R-21-4)

To Amtrak and all Class I railroads:

> Eliminate the use of train approach warning protection in controlled track territory during planned maintenance and inspection activities. (R-21-5)

4.2. Previous Recommendation Reiterated in this Report

As a result of this investigation, the National Transportation Safety Board reiterates the following safety recommendation:

To Amtrak:

> Conduct a risk assessment for all engineering projects and use the results to issue significant speed restrictions for trains passing any engineering project that involves safety risks for workers, equipment, or the traveling public, such as ballast vacuuming, as part of a risk-mitigation policy. (R-17-23)
>
> This safety recommendation is currently classified "Open—Acceptable Response."

4.3 Previous Recommendation Reiterated and Classified in this Report

As a result of this investigation, the National Transportation Safety Board proposes classifying the following safety recommendation:

To the Federal Railroad Administration:

> Define when the risks associated with using train approach warning are unacceptable and revise Title 49 *Code of Federal Regulations* 214.329 to prohibit the use of train approach warning when the defined risks are unacceptable. (R-20-6)

This safety recommendation was previously classified "Open—Initial Response Received" on April 16, 2021. This recommendation is now classified "Open—Unacceptable Response."

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

JENNIFER HOMENDY
Chair

MICHAEL GRAHAM
Member

BRUCE LANDSBERG
Vice Chairman

THOMAS B. CHAPMAN
Member

Date: September 27, 2021

Appendixes

Appendix A. The Investigation

The National Transportation Safety Board (NTSB) was notified on April 24, 2018, that a northbound Amtrak (National Railroad Passenger Corporation) train had struck an Amtrak watchman near Bowie, Maryland, on Amtrak's Northeast Corridor. The NTSB launched an investigator-in-charge and a system safety investigator to investigate the accident on April 24, 2018.

Parties to the investigation included Amtrak, the Federal Railroad Administration (FRA), the Brotherhood of Maintenance-of-Way Employes Division, and the Brotherhood of Locomotive Engineers and Trainmen.[28]

[28] The Brotherhood of Maintenance-of-Way Employes Division spells the word "Employes" in its name with one e. Therefore, we are using that spelling in this report.

Appendix B. Consolidated Recommendation Information

Title 49 *United States Code* (*USC*) 1117(b) requires the following information on the recommendations in this report.

For each recommendation—

(1) a brief summary of the NTSB's collection and analysis of the specific accident investigation information most relevant to the recommendation:

(2) a description of the NTSB's use of external information, including studies, reports, and experts, other than the findings of a specific accident investigation, if any were used to inform or support the recommendation, including a brief summary of the specific safety benefits and other effects identified by each study, report, or expert; and

(3) a brief summary of any examples of actions taken by regulated entities before the publication of the safety recommendation, to the extent such actions are known to the Board, that were consistent with the recommendation.

To the Federal Railroad Administration:

R-21-3

Modify Title 49 *Code of Federal Regulations* Part 214 to prohibit the use of train approach warning in controlled track territory during planned maintenance and inspection activities.

Information that addresses the requirements of 49 *USC* 1117(b), as applicable, can be found in section 2.4, Roadway Worker Protection. Information supporting (b)(1) can be found in section 2.4, Roadway Worker Protection; Information supporting (b)(2) can be found in section 2.4, Roadway Worker Protection; (b)(3) can be found on pages 31-34.

To Amtrak:

R-21-4

Modify your site-specific safety work plan to require all work zone hazards for roadway workers and watchmen be identified and mitigated, including hazards in multiple main track work zones.

Information that addresses the requirements of 49 *USC* 1117(b), as applicable, can be found in section 2.2, Site-Specific Safety Work Plan. Information supporting (b)(1) can be found in section 2.2, Site-Specific Safety Work Plan; Information supporting (b)(2) can be found in section 2.2, Site-Specific Safety Work Plan; (b)(3) can be found on pages 24-28.

To Amtrak and the Class I Railroads:

R-21-5

Eliminate the use of train approach warning protection in controlled track territory during planned maintenance and inspection activities.

Information that addresses the requirements of 49 *USC* 1117(b), as applicable, can be found in section 2.4, Roadway Worker Protection. Information supporting (b)(1) can be found in section 2.4, Roadway Worker Protection; Information supporting (b)(2) can be found in section 2.4, Roadway Worker Protection; (b)(3) can be found on pages 31-34.

Appendix C. Prior Train Approach Warning Accidents

Roadway worker protection (RWP) and the use of train approach warning (TAW) have been safety issues in recent NTSB railroad accident investigations. In addition to this accident, the NTSB has completed several investigations in recent years where TAW was being used as the method of on-track protection.

Providence, Rhode Island

On March 13, 2008, about 1:11 p.m. local time, eastbound Amtrak Acela train 2154, en route from New York to Boston, struck a contractor and an Amtrak maintenance-of-way track foreman at milepost (MP) 185+515 in Providence, Rhode Island (NTSB 2009). The train was traversing a 4° 23' curve at about 51 mph when the engineer initiated an emergency brake application just prior to the collision. The train came to a stop 564 feet past the point of impact. Train 2154, consisting of two power cars and six coaches, was carrying 162 passengers. There were no reported injuries to any of the passengers or train crew. As a result of the train strike, a contractor was killed, and an Amtrak track foreman and watchman were seriously injured. At the time of the accident, the Amtrak track foreman had released foul time on the active track and the crew was being protected by a watchman providing TAW.

As a result of this investigation, the NTSB determined that the probable cause of the accident was the "foreman's failure to communicate critical changes made to on-track safety protections and to utilize all assigned trackmen as watchmen while working in a hot spot. Contributing to the accident was the watchman's failure to recognize that he was poorly positioned to perform his duties."

Edgemont, South Dakota

On January 17, 2017, about 10:09 a.m. local time, BNSF Railway (BNSF) westbound train E DOLEBM0 01E, traveling at 35 mph, struck and killed two roadway workers, including the watchman (NTSB 2018). The accident occurred at MP 477, on the Black Hills subdivision, in Edgemont, South Dakota. The three-member roadway work group had been cleaning snow and ice from the track switch on the main track to prepare for the movement of a train that was to have its air brake system tested in a stationary test on the main track. The crew of the striking train sounded the train horn and bell, and both members of the train crew applied emergency braking; however, there was no response from the roadway work group, and the train was unable to stop before reaching the work location.

The NTSB determined that the probable cause of the accident was:

> the improper use of TAW by the BNSF roadway work group to provide on-track safety. Contributing to the accident was incorrect information provided in the job briefing, including a miscalculated sight-distance assessment. Also contributing to the accident was the failure of BNSF to provide the watchman with the necessary equipment to alert the work group of oncoming trains and equipment. Further

contributing to the accident was the FRA's inconsistent enforcement of federal regulations requiring that railroads equip watchmen.

As a result of the Edgemont investigation, the NTSB issued Safety Alert *Watchman/Lookout: Your coworkers depend on you* (NTSB 2017a). The safety alert was distributed to the Class I railroads, the Brotherhood of Railroad Signalmen, and the Brotherhood of Maintenance of Way Employes. The alert was meant to: (1) highlight the hazards involved in the use of TAW as a form of on-track safety for roadway work groups, and (2) to heighten awareness of these hazards by the roadway workers who depend on this form of on-track safety.

Queens Village, New York

On June 10, 2017, at 10:12 a.m. local time, Long Island Rail Road (LIRR) train 7623 on track 3 approached a five-member crew of roadway workers at the Queens Interlocking in Queens Village, New York (NTSB 2020). The foreman and three roadway workers were inspecting and making minor repairs to track 1 within the Queens Interlocking. A fifth roadway worker was clear of the tracks, keeping pace with the work group. Upon seeing train 7623, the watchman sounded a handheld horn, yelled at the other workmen, and raised a paddle that told the engineer to sound the train's horn. The engineer then sounded the train's horn. Three of the roadway workers remained in track 1, but the foreman stepped into the path of the train on track 3 and was killed. The train was traveling about 78 mph when the engineer applied the emergency brakes just before impact.

As a result of the investigation, the NTSB determined that the probable cause of the accident was "LIRR's decision to use TAW to protect the roadway workers. Also contributing was LIRR's labor-management agreements that impact safe work/rest periods and may allow employee fatigue."

References

FAMES (Fatality Analysis of Maintenance-of-Way Employees and Signalmen). 2018. *Fatal Accidents Under Train Approach Warning (Watchman/Lookout),* Washington, DC: US Department of Transportation, Federal Railroad Administration, FAMES.

FRA (Federal Railroad Administration). 2018. *Track and Rail and Infrastructure Integrity Compliance Manual,* Volume III Railroad Workplace Safety, Chapter 3 Roadway Worker Protection. Washington, DC: US Department of Transportation, FRA.

NTSB (National Transportation Safety Board). 2020. *Long Island Rail Road Roadway Worker Fatality, Queens Village, New York, June 10, 2017*. RAR-20/01. Washington, DC: NTSB.

----. 2018. *BNSF Railway Roadway Worker Fatalities, Edgemont, South Dakota, January 17, 2017.* RAR-18/01. Washington, DC: NTSB.

----. 2017. *Amtrak Train Collision with Maintenance-of-Way Equipment, Chester, Pennsylvania, April 3, 2016.* RAR-17/02. Washington, DC: NTSB.

----. 2017a. *Watchman/Lookout: Your coworkers depend on you*. SA-066. Washington, DC: NTSB.

----. 2009. *Roadway Workers Struck by Amtrak Acela Train 2154, Providence, Rhode Island, March 13, 2008.* RAB-09/04. Washington, DC: NTSB.